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A STUDY OF CORE MATERIAL INDUCTION
PURSUANT TO THE UNITED STATES ARMY'S
TWO AND ONE-HALF TON TRUCK REMANUFACTURE

An MSA 685 Integrative Paper
Submitted To:
Dr. Hal W. Stephenson, Monitor
In Partial Completion of the Degree of
Master of Science in Administration
Central Michigan University

Submitted by:

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MICHAEL G. SIMPSON
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MARK C. DROUILLARD
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DEDICATION

This research project is dedicated to my wife Barbara,
my children, David, Jonathan, Elizabeth, and Mary and
United States Army truckers around the world.

EXECUTIVE SUMMARY

The Army's medium truck fleet is in need of replacement. This is being accomplished by the Family of Medium Tactical Vehicles (FMTV) program. Due to budget priorities, however, the entire fleet cannot be replaced. As a result, the Army has established an extended service program to remanufacture 2 1/2 ton cargo trucks for lower priority National Guard and Army Reserve units. Various Congressional committees have directed the Army to extend the life of the 2 1/2 ton truck by 80% of a new truck at approximately one-half the cost. In September 1993, the Army contracted with AM General Corporation, of South Bend, Indiana, for 2,483 trucks for approximately \$150 million.

The Army will provide the contractor three old trucks for every two "like-new" trucks delivered. The remanufactured trucks will have a new engine, new automatic transmission, Central Tire Inflation System (CTIS), single radial tires, new brakes, power-assist steering, rustproofing, and new hoses and wiring. The condition of core material or candidate vehicles is critical to the Army's cost-saving efforts. Defining the ratio by identifying the salvage potential of candidate vehicles has the potential of saving dollars by decreasing shipping and reducing disassembly requirements.

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CHAPTER 1: DEFINITION OF THE PROBLEM

Background

As early as 1985, the United States Army began investigating the possibility of remanufacturing some of its older wheeled vehicles as a means to reduce the burdensome operating and support costs. Traditionally, wheeled vehicles were retired at the end of their service life and new vehicles were acquired as replacements. The total number of wheeled vehicles required for the Army is based on each unit's operating scenario and mission profile as well as their current training activities. The Transportation School, located at Ft. Eustis, Virginia, is responsible for developing the requirements for wheeled vehicles for the Army. The Army has three groups of vehicles based on carrying capacity: light vehicles (one-quarter ton to five-quarter tons), medium vehicles (two and one-half tons to five tons), and heavy vehicles (greater than five tons). In 1985, the medium fleet had the oldest vehicles and the Army was spending more money per truck to maintain and operate these vehicles.

Acquisition of the Army's equipment is made by the Army Acquisition Executive (AAE) who is also the Assistant Secretary of the Army for Research, Development, and Acquisition (ASA(RDA)). Each category

of equipment, such as communications, tracked vehicles, aircraft, and trucks, for example, is acquired by the AAE's executing offices or Program Executive Offices (PEO). The PEO-Combat Support, located in Warren, Michigan is the particular office tasked to acquire new trucks. The various PEOs have a matrix support arrangement with the functional commands responsible for technical support. The functional commands are also arranged by category of equipment. The Tank-Automotive Command (TACOM) located in Warren, Michigan is the functional command responsible for technical support to the PEO-Combat Support.

In 1986, TACOM was tasked by Headquarters, Department of the Army, to develop a Service Life Extension Program (SLEP) for the medium truck fleet. No funding, however, was allocated for this project. TACOM provided the personnel out of their general budget to study the problem and develop acquisition strategies. By 1988, the then AAE, Mr. Ambrose, decided to terminate the project. His decision was based on a perception that a SLEP was a threat to future new truck procurement because it extended the life of old vehicles thereby reducing the requirement for new vehicles thus diminishing the argument to Congress for increased new truck funding. At this time, the PEO-Combat Support was in the midst of

developing the largest medium truck acquisition in the history of the Army through the Family of Medium Tactical Vehicles (FMTV) program. At this point, the Congress stepped in.

The Army treats Congressional committee language as mandated guidance and acts accordingly. The four committees that normally provide language are the House Armed Services Committee (HASC), the Senate Armed Services Committee (SASC), the House Appropriations Committee (HAC), and the Senate Appropriations Committee (SAC). Several cost studies had shown that a SLEP had the potential to provide operating and support cost savings as well as procurement savings to the Army (Dicesare, 1991, Meng, 1989, and Gotham, 1987). During 1990 and 1991, the several Congressional committees provided language directing the Army to establish a medium truck SLEP office under the PEO-Combat Support (U. S. Congress, House, 1991, p. 421 and U. S. Congress, Joint, 1991). The committees said that the Army should attempt a medium truck SLEP that extends the life of the vehicles by 80% of a new vehicle (this equates to sixteen years) at 50% of the cost of a new vehicle. Lastly, the committees said that the money for the FMTV contract award would not be released until a SLEP solicitation was issued to industry.

A SLEP request for proposal (RFP) for the remanufacture of the two and one-half ton trucks was released to potential bidders in August 1991. Five ton trucks were not included in this RFP because the Army was in the midst of rebuying five ton trucks. A product office was established under the PEO-Combat Support and designated Product Manager-Extended Service Program (PM-ESP) in September 1991. The source selection process for prototype contracts began in December 1991 after responses were received from industry. One of the potential bidders was Tooele Army Depot, located in Tooele, Utah teamed with Teledyne-Brown Engineering Corporation. In November, 1991, Congress passed the Capital Statute Act which stated that a Government depot could act as a subcontractor to a prime contractor regarding a defense contract. This law was passed specifically with the SLEP solicitation in mind. The Secretary of the Army, Michael Stone, decided that Tooele could not bid on the SLEP contract because the Army had to develop the policies and procedures to implement the new law which would adversely impact the two and one-half ton truck SLEP solicitation schedule.

In May, 1992, two prototype contracts were awarded for the remanufacture of two and one-half ton cargo trucks. One contract was awarded to AM General

Corporation of Livonia, Michigan and the other contract was awarded to Cummins Military Systems, Inc. of Columbus, Indiana. The Army provided each contractor with nineteen old two and one-half ton trucks for each contractor to remanufacture eight prototype trucks for testing. Congress wanted the SLEP idea verified, thus the need for prototype testing. Prototype testing was performed at Aberdeen Proving Ground, Maryland and Yuma Proving Ground, Arizona. The testing included 20,000 miles of endurance testing per truck and some performance testing such as deep-water fording, transportability, and steering.

The prototype trucks included a new engine, new transmission, new single radial tires, a new brake system, power-assist steering, and a Central Tire Inflation System (CTIS). None of these components were on the original vehicles. No study to date, however, has examined the minimum acceptable criteria for the induction of core material. Core material for this specific program is defined as an old two and one-half ton truck minus the engine, transmission, tires, electrical lines, belts, and hoses. A tailored inspection sheet was developed for induction of these old trucks (Appendix 1). A draft RFP for the production phase of the program was released to the two prototype contractors in December 1992. A production

contract award was signed on September 20, 1993.

Purpose

The study seeks to provide a rationale for future business decisions for the Army regarding induction of wheeled vehicle core material for an extended service program. The researcher analyzed how candidate core vehicle quantity, condition, and type effected expected deliverable vehicle quantity, condition, and type. The researcher examined the value of inducted vehicles compared to the cost of remanufacture.

Problem Statement

The researcher examined the United States Army's two and one-half ton truck Extended Service Program for cost effectiveness. The objective of this research was to determine:

- 1) What should be the minimum acceptable maintenance criteria for the induction of vehicles for remanufacture?
- 2) What should be the optimum quantity and model mix of vehicles for induction including the ratio of core material to deliverables?
- 3) What should be the value of the candidate vehicles compared to the anticipated expenditures for remanufacture?

Definition of Terms

Core Material - an item of hardware, or a component of

an item of hardware, that has reached a stage in its life cycle in which a decision is made to extend its life by either rebuild, overhaul, or remanufacture.

Deliverable - an item, or a service, provided as a result of a contract.

Prototype - usually a completely working item of hardware developed for testing as a precursor to a full rate production model.

Purchase Description - this document is a detailed hardware specification of the item to be delivered to the Government by a contractor. A performance specification describes how the item is to function. A design specification describes how the contractor is to build the item. Most new military specifications now attempt to describe performance instead of design.

Rebuild/Overhaul - used interchangeably, under the category of wheeled vehicles and components, to bring an item back as closely as possible to its original state. An item that is rebuilt or overhauled retains its original identity.

Remanufacture - under the category of wheeled vehicles, to disassemble, replace or repair some components with like components, and insert new components and new technology where reasonably cost

effective. A vehicle that undergoes a remanufacture loses its original identity and acquires a different identity based on the insertion of components different from the original. The item acquires a life extension based on its "like-new" condition.

Request for Proposal (RFP) - a standard Government RFP will normally contain sections "A" through "L". Section "B" asks for costs. Section "C" contains specific technical aspects based on a Purchase Description which is usually attached. Section "E" describes the quality requirements. Section "F" describes a delivery schedule. Sections "L" and "M" contain the evaluation criteria for contract award. The other sections contain standard Government clauses per United States procurement laws and Government regulations. After contract award, Sections "L" and "M" are deleted. This document is also referred to as a solicitation.

Limitations

The researcher used prices listed in the Army Master Data File (AMDF). Prices listed in the AMDF are based on original purchase price and then adjusted each year with inflation factors. For instance, an item purchased by the Army in 1982 and not purchased since

will be listed in the AMDF in 1993 as a price reflecting original price with the inflation factors for each year since 1982 calculated. This price obviously does not represent real value. No attempt by the Army has been made to figure in depreciation in the AMDF.

The researcher used prices listed in HAYSTACK. This data file lists prices paid by the Army according to contract. The latest rebuy of components are listed and represent the latest value for an item. This file, however, does not include all components for a given vehicle. The prices listed often reflect small quantity buys and are not adjusted for inflation. The researcher adjusted for inflation in line with the AMDF. The Army Materiel Systems Analysis Activity, which conducts studies for the Army, uses AMDF prices when conducting cost studies.

The researcher used inspection sheets filled out by individuals who may or may not be qualified to inspect the vehicles. Although this cannot be verified, the researcher is assuming that an inspector has some experience with the vehicle.

CHAPTER 2: REVIEW OF THE LITERATURE

Introduction

The literature review was narrowed to focus on remanufactured wheeled vehicles and related automotive/truck components. The literature discusses various business decisions to consider when contemplating a remanufacture. The first question is what is the desired outcome or what level of performance is desired? In other words, in the case of transportation, what is the movement requirement? The second question is, what is the current status of the transportation assets or how well is the current fleet performing? Third, the literature discusses the pros and cons of a new acquisition versus salvaging existing assets either by rebuilding or remanufacturing.

Literature Review

Requirement Definition

When contemplating an acquisition decision, fleet managers must first consider their ultimate outcome or transportation requirement. The researcher, after reviewing the literature, found that most of the writers assumed the transportation requirement was defined and proceeded into the trade-offs of either buying new equipment or remanufacturing or rebuilding the existing equipment. The Army will not proceed with a hardware solution until the requirement is

definitized. Normally, performance is documented and specifications are written to meet the requirement. Proposals are then based on the specification. Industry seems to operate much the same. Hardware is designed to meet a specification which is based on a transportation activity that a business needs to perform. Government activities seemed to focus on initial capital outlay compared to the usefulness of the item. Industry seemed to be more focused on return on investment.

Service life was a theme throughout the review. The decision maker was asked to determine, "What do you want out of your truck? Another five years of trouble-free service?" (Winsor, 1991). This is an example of what a decision-maker must decide before contemplating the options of new, remanufactured, or rebuilt. The Army has determined expected service life for its vehicles based on expected use and mission profiles. In the case of the two and one-half ton truck Extended Service Program, Congressional committee language specified 80% service life of a new truck or 16 more years of service. Under Urban Mass Transportation Administration (UMTA) Bus Rehabilitation Guidelines, the expectation for a bus remanufacture is 8-10 years (Bridgman and others, 1983, p. 4) of additional service life. The State of Florida established a minimum of

five years extended life for their mass transit system rehabilitation (Florida Department of Transportation, 1980, p. 2-2) in order to meet the Federal funding requirements set by UMTA.

The literature discussed or assumed that the decision-maker would be the recipient of the item once rebuilt or remanufactured. This may not necessarily be true. In the case of the Army, for instance, new vehicles will be fielded to the active Army and the remanufactured vehicles will be issued to the National Guard and Army Reserve. The National Guard and Army Reserve operate about 20% less miles per year than the active Army. The Army is using Reliability, Availability, Maintainability, and Durability (RAM-D) calculations gathered during prototype testing to validate the wheeled vehicle remanufacture concept.

Core Evaluation

The literature discussed evaluating the core material when considering a remanufacture. Industry evaluation of core material intended for remanufacture or restoration was based more on value.

A variable factor in a restoration decision is used truck prices at a given moment. Whether the truck to be restored is taken from the existing fleet or purchased from outside, its market value has a considerable impact upon the

total cost of the restoration (Smiley, 1983, p. 26).

Other industry considerations include writing off the purchase price of a new truck for tax purposes depending upon the firm's capital position (Smiley, 1983, p. 26). Maintenance facilities must also be taken into consideration as well as the labor and capability to determine the scope of the work.

If a long-life extension is desired for a minimum investment, UMTA Bus Guidelines suggests selecting the "best vehicles" (Bridgman and others, 1983, p. 12) for core material. UMTA Bus Guidelines appropriate criteria for the core material include (Bridgman and others, 1983, p. 11-12):

- Number of road calls per vehicle.
- Number of maintenance hours per vehicle.
- O&M cost per vehicle.
- Mechanical condition.
- Age.
- Interior and exterior condition.

UMTA also suggests that another possibility is the purchase of rehabilitated vehicles (Bridgman and others, 1983, p. 12). Finally, UMTA suggests that the "worst vehicles" might be chosen for core material if maintenance facilities were overburdened, thus providing relief to the maintenance activity (Bridgman

and others, 1983, p. 12).

Decision Factors

Actual decision factors for a Government activity are varied regarding the actual decision whether or not to purchase new or rehabilitate existing vehicles.

UMTA suggests the following decision criteria (Bridgman and others, 1983, p. 16-17):

- Fleet standardization.
- Fuel economy.
- Ease of maintenance and training.
- Operational familiarities.
- Public image.
- Fleet age balancing.
- Acquisition lead time.
- Time out of service.
- Availability of parts.
- Availability of funds.
- Local and state requirements.

Industry criteria for the decision is based more on cost. Most of the literature expressed feasible decision points as a percentage of a new vehicle. For the Army's Extended Service Program, Congressional guidance stated that the cost should not exceed 50% the cost of a new vehicle. Industry criteria include ("Pros, Cons of Rebuilt...", 1982, p. 16):

- Writing off the repair as a business expense for

taxes.

- Weighing features that would have been available on a new truck.
- Component replacement with rebuilt components.
- Reducing down time for maintenance.
- Facility availability.
- Reducing shop labor costs.
- Improve repair quality.
- Reduction of Costs.

Summary

In summary, a rehabilitation decision for wheeled vehicles depends upon desired service life and intended use of the vehicle. The condition of the core material is critical to a decision whether or not to rehabilitate or buy new. Lastly, criteria for both industry and Government concerning a decision as to whether or not to buy new or rehabilitate can be seen as more of a cost decision for industry than for Government.

CHAPTER 3: METHODOLOGY

Problem Statement

The researcher examined the Army's two and one-half ton truck Extended Service Program for cost effectiveness. The objective of this research was to determine:

- 1) What should be the minimum acceptable maintenance criteria for the induction of vehicles for remanufacture?
- 2) What should be the optimum quantity and model mix of vehicles for induction including the ratio of core material to deliverables?
- 3) What should be the value of the candidate vehicles compared to the anticipated expenditures for remanufacture?

Population Description

The current total world-wide fleet of Army two and one-half ton trucks is about 45,000 according to the National Inventory Control Point, Tank-Automotive Command, Warren, Michigan. The two and one-half ton truck Extended Service Program is limited to cargo trucks within the Continental United States (CONUS). This is about 40,000 vehicles. Currently, vehicles being disposed of are usually more than 25 years old. Of the 40,000 CONUS vehicles, about 13,000 vehicles might be considered candidates for induction based on

age.

Actual program requirements were developed by the political process. Based on the Fiscal Year 1993 Amended President's Budget, about 2,400 (480 per year) vehicles were expected to be delivered to the Army over a five-year period. The quantity to be inducted has been estimated to be in a ratio of three old vehicles for two "like-new" vehicles or about 3,600 (720 per year) old vehicles. This ratio, however, is not based on an analysis, but is a best guess developed during the prototype phase. The population of candidate vehicles identified for the Extended Service Program is currently about 1,100 trucks of which 349 have been inspected.

Inspection sheets have been collected from Ft. Bragg, North Carolina (171), Ft. Devens, Massachusetts (11), Ft. Dix, New Jersey (53), Ft. Polk, Louisiana (66), Ft. Stewart, Georgia (20), Selfridge Air National Guard Base, Michigan (3), and Tooele Army Depot, Utah (25). A sample inspection sheet is at Appendix 1. After the first program year, candidate vehicles will come from the old trucks displaced by new vehicle fieldings and old trucks displaced by remanufactured vehicle fieldings. Each candidate truck sent to a contractor to be remanufactured must be disassembled, components refurbished, new components added, and the

vehicles built. The quantity of candidate vehicles sent to a contractor directly effects the program costs and unit hardware costs. The Congressional committees have asked the Army to limit the cost of remanufactured trucks to one-half the cost of a new truck.

The researcher used descriptive statistics to analyze the data from the raw information collected from the inspection sheets to determine an estimated vehicle value. Components listed on the inspection sheets were cross-referenced to the Army's two main sources of prices to determine an estimated value for the vehicles' components. These two data bases are the Army Master Data File (AMDF) and HAYSTACK. The prices then identified with each component were treated as weights. If an item "passed", then the component received its weight. If an item "failed", then no weight was assigned. Unmarked items were treated as "failed". Each type of vehicle was assigned a salvage potential by percentage based on its pass/fail criteria.

The researcher used descriptive statistics to analyze the data collected from the inspection sheets to determine the maintenance condition. The maintenance condition is an indicator of work needed to refurbish components. The estimated value and the maintenance condition were used to estimate a ratio or

percentage of inducted vehicles to deliverable vehicles. These two criteria, estimated value and maintenance condition should identify a vehicle's worth or salvage potential. The current estimate for the Army's Extended Service Program is 66% or three old trucks inducted for every two new trucks delivered. Refining the ratio could save unneeded disassembly and excess shipping costs.

CHAPTER 4: ANALYSIS OF DATA

Inspection Sheets

Between December 1992 and July 1993, the researcher collected 349 inspection sheets from seven locations in the United States. These locations were all Army installations:

1. The Director of Logistics at Ft. Bragg, North Carolina provided 171 inspection sheets. Ft. Bragg primarily hosts the XVIII Airborne Corps which includes the 82nd Airborne Division.
2. The Director of Logistics at Ft. Devens, Massachusetts provided 11 inspection sheets. Ft. Devens primarily hosts military intelligence units.
3. The Director of Logistics at Ft. Dix, New Jersey provided 53 inspection sheets. Nearly all units at Ft. Dix have been deactivated. The excess trucks inspected at Ft. Dix were used by the former Army Driver Training School.
4. The Director of Logistics at Ft. Polk, Louisiana provided 66 inspection sheets. Ft. Polk is now primarily a Joint Readiness Training Center.
5. The Director of Logistics at Ft. Stewart, Georgia provided 20 inspection sheets. Ft. Stewart primarily hosts the 24th Infantry Division.
6. The Product Manager, Extended Service Program provided 3 inspections sheets from Selfridge Air

National Guard Base, Michigan. These three trucks had been randomly selected from the Army's excess report as typical examples of candidate vehicles. The Extended Service Program prototype contractors used these vehicles in preparing their proposals.

7. The supply division at Tooele Army Depot, Utah provided 25 inspection sheets. These trucks were inspected during the development of the inspection sheet itself.

The components associated with the inspection sheets were derived from the Army Technical Parts Manual for the 2 1/2 Ton Truck, TM 9-2320-361-34P. The prices for the parts were derived from the AMDF and HAYSTACK and the following table was developed.

Table 1

2 1/2 Ton Truck Candidate Vehicle Component Cost Estimate

Component	Inspection Sheet Cross-Reference	NSN/Part Number	Cost
Front Bumper w/w	1	10871535-1	*423.25
Front Bumper wo/w	1	875756-1	*427.10
Fender, Driver's Side	2	2510004896005 10872065-1	324.70
Fender, Pass. Side	14	2510000650952 10872064	292.10
Door, Left	3	2510007373293 7373293	213.00
Door, Right	13	2510007373294 7373294	208.00
Cab, Kit	4	2510011612127 12300779	1,927.00
Windshield	5	2510009538976 7748623	79.37
Windshield, Left	7	5340006960264 7373321	43.75
Windshield, Right	7	5340006960265 7373322	64.06
Cab Soft Top Kit	6	2540011550104 12300649	55.71
Cab Right Post	6	2510007409597 7409597	36.05
Cab Left Post	6	2510007409596 7409596	30.89
Bow & Tarp Kit	6	2540003228957 11672526	700.20
Bow & Tarp Kit (XLWB) (Info Only)	6	2540003271845 11672525	704.00

Table 1 (Cont.)

2 1/2 Ton Truck Candidate Vehicle Component Cost Estimate

Component	Inspection Sheet Cross-Reference	NSN/Part Number	Cost
Cargo Body	8	2510011198830 7370332	1,660.00
Tailgate (XLWB, FS)	8	2510007370210 7370210	210.19
Tailgate (DS)	8	2510008985415 11611570	208.00
Troop Seats (DS, FS)	8	2540013438694 10937950	1,256.02
Pioneer Tool Rack	9	2540011915914 12301034	49.69
Trailer Connector	10	4730005950083 MS35746-1	13.08
Tow Pintle	11	2540007760103 7760103	156.29
Rear Bumperettes	12	2540000402209 8345185	108.66
Battery Box	13	6160013180763 12375366	156.00
Shock Absorbers	15	2510002946339 7539007	40.52
Transfer Case	16	2520000898287 11609224	1,730.00
Torque Rods	17	2530006789029 8757685	283.86
Front Axle	18	2520005728719 7521734-1	5,078.00
Front Differential	19	2520006926098 A1-3800X466	2,030.00
Intermediate Axle	20	2520007368511 C240FHX3	2,942.00

Table 1 (Cont.)

2 1/2 Ton Truck Candidate Vehicle Component Cost Estimate

Component	Inspection Sheet Cross-Reference	NSN/Part Number	Cost
Rear Axle	22	2520007368511 C240FHX3	2,942.00
Rear Differential	23	2520006926098 A1-3800X466	2,030.00
Universal Joints	24	2520000751762 8738035-1	268.82
Spare Tire Carrier	25	2510007521160 SPLSDM54	88.41
Cargo Body (XLWB)	8	2510011787348 8757820	6,022.00
Cargo Body (DS)	8	2510009997804 10937903	4,473.00
Dummy Coupling	10	2530002703878 7014965	4.10
Bracket	10	5340004118358 11609554	17.52
Front Axle Housing	18	3040011787373 8757794-1	685.00
Differential Carrier,	19, 21, 23	7700132	*597.79
Intermediate Differential	21	252000692098 A1-3800X466	2,030.00
Winch	Based on Model Type	2590007538687 7538687	1,195.00

Note: All costs are from the latest Army Master Data File except
"*" which are from the HAYSTACK database.

Data Compilation

The costs for each component part was summed for each corresponding inspection sheet item and the summed item number treated as a weight for that item. If the item "passed" based on the inspection sheet criteria (see APPENDIX 1), then the weight was applied to that item. If the item "failed" or was left blank, then no weight was applied. The raw pass/fail data with the summed weights applied for each inspection sheet item is at APPENDIX 2.

For each truck, the items were summed and divided by a total number and multiplied by 100 to derive a salvage potential percentage. This percentage then represents how much of that particular truck could be used for core material for remanufacture. The total number that was used to divide the summed items varied by vehicle model as shown in the following table.

Table 2
Total Number, by Model, if Every Item Passed

	With Winch	Without Winch
Fixed-Side	30,211.24	29,016.24
Drop-Side	33,022.05	31,827.05
Long Bed	33,945.23	32,750.23

The models as reported on the inspection sheets included:

1. The M35A2, 2 1/2 ton truck. This vehicle comes equipped either with or without a front self-recovery winch and the cargo bed has a fixed-side.
2. The M35A2C, 2 1/2 ton truck. This vehicle comes equipped either with or without a front self-recovery winch and the cargo bed sides can be lowered for easier loading of cargo, hence "drop-side".
3. The M36A2, 2 1/2 ton truck. This vehicle comes equipped either with or without a front self-recovery winch and the bed is extra long for handling out-sized, but not heavier, cargo, hence "long bed".

The salvage potential percentages as well as the mileage data collected from the inspection sheets is listed at APPENDIX 3. FS% = fixed side vehicles, DS% = drop-side vehicles, and LB% = long bed percentages. The pass/fail decision was determined by the maintenance division at the Tank-Automotive Command, Warren, Michigan prior to the analysis by the researcher. This decision was made based on the experience of the maintenance division personnel.

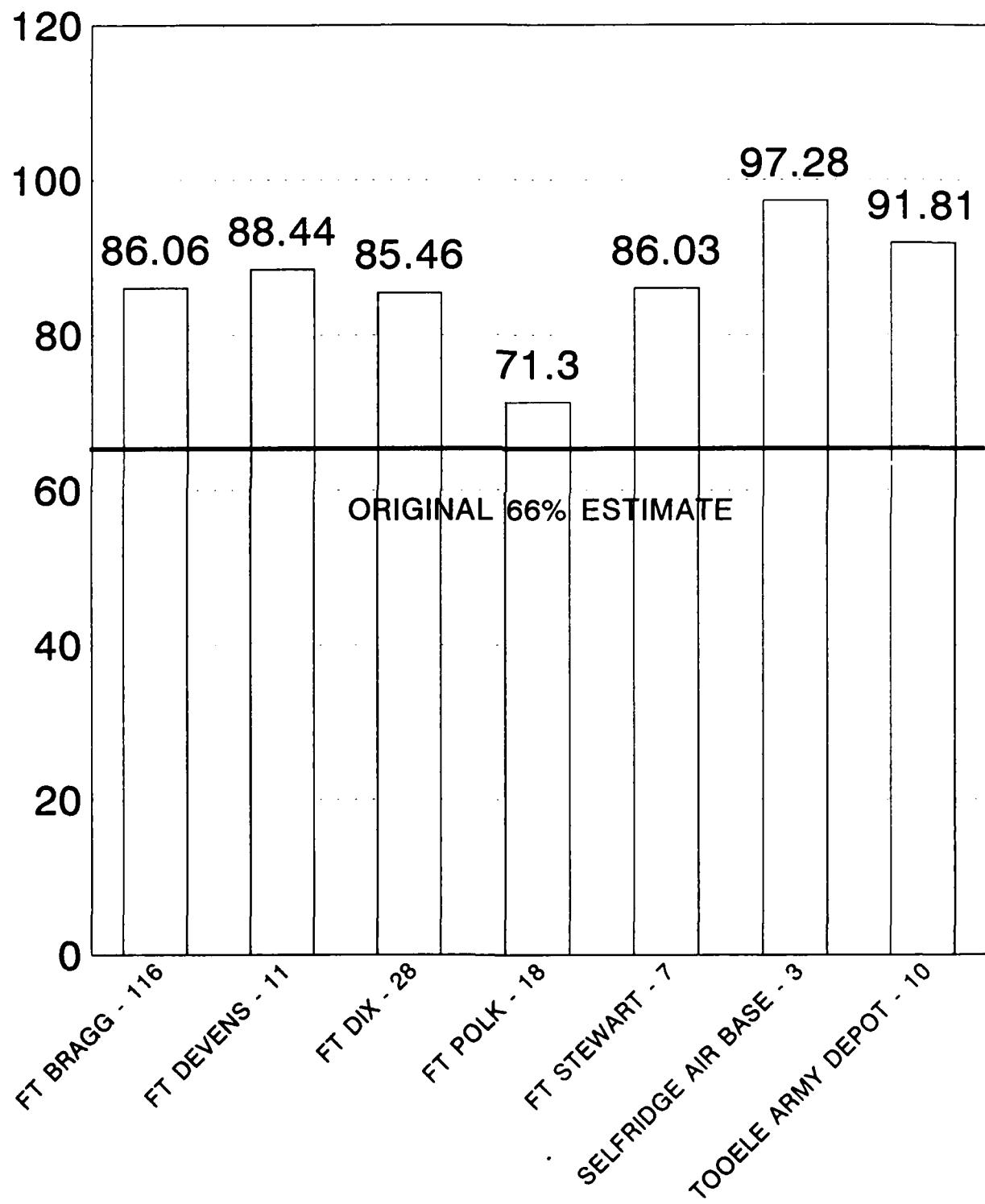
Statistics

The researcher conducted a statistical analysis on the mileage, salvage potential, and pass/fail summary for each location. The statistical tables are listed

at APPENDIX 4. The statistics are arranged in five groups: 1) pass, fail, all, 2) mileage pass, mileage fail, mileage all, 3) fixed-side pass, fixed-side fail, fixed-side all, 4) drop-side pass, drop-side fail, and drop-side all, and 5) long bed pass, long bed fail, and long bed all. Statistics listed are based on the data at APPENDIX 3 and include the count, the maximum, the minimum, the average, the standard deviation, and the variation. If no statistic was listed, then that particular data point was insignificant.

Table 3 summarizes the average salvage potential for fixed-side vehicles that passed by location. The fixed-side vehicles were the most numerous. The salvage potential, though listed as a percentage and not listed in dollars, represents the candidate vehicles' worth to the Army. The "pass" represents the minimum maintenance criteria. The original Extended Service Program guess for core material was three old trucks for every two new vehicles which equates to a 66% salvage potential. The data, as displayed in this table, depicts a surprisingly higher salvage potential.

TABLE 3
FIXED-SIDE TRUCKS (PASSED)
AVERAGE SALVAGE POTENTIAL %



CHAPTER 5: CONCLUSION AND RECOMMENDATION

Conclusion

This analysis was an attempt by the researcher to search for efficiencies in the Army's Extended Service Program. The inherent problems associated with a cost-benefit analysis were accepted and no attempt was made to make this a cost-benefit analysis. The actual cost of contract DAAE07-93-C-R110, dated September 20, 1993, between the Army and AM General Corporation of South Bend, Indiana is \$149,474,191.00 over five years to remanufacture 2,483 trucks. The money for this contract, of course, comes from taxpayers. The benefits go directly to the Army National Guard and Army Reserve, but indirectly back to the taxpayer.

Generally, people receiving benefits from a project are not the same ones bearing the costs (Browning, 1979, p. 93).

These remanufactured trucks will allow the Army National Guard and the Army Reserve to be more efficient.

Improved efficiency for the Army National Guard and Army Reserve has direct consequences. Theoretically, during the Los Angeles riots, the old 2 1/2 ton trucks used by the California Army National Guard should not have been allowed into the Los Angeles basin because the engines in the old trucks did not

meet the air quality standards for that particular weight class vehicle. Obviously, the emergency situation overruled this requirement. Nevertheless, the Extended Service Program trucks will have a new engine that meets the 1993 EPA standards. Not enough vehicles, however, are being purchased on this contract to meet the current truck requirement of the Army National Guard and Army Reserve.

Since the unit price of the vehicles is fixed in the contract, any efficiencies derived in other areas of the contract, such as the shipping of core material, or the quantity of core material to be disassembled, could result in an increase in the quantity of vehicles purchased. The more old vehicles that are replaced, then, result in an improved ability of the Army National Guard and Army Reserve to respond to emergencies such as riots, hurricanes, and flood relief. These trucks are used for practical purposes such as carrying soldiers, carrying supplies such as food, tents, and sandbags, and hauling other equipment such as water trailers. In addition, the trucks are shipped overseas to meet National commitments such as the liberation of Kuwait when Army National Guard and Army Reserve units deployed as part of that effort.

The dollars provided by the Congress also are fixed for this contract and any improvement in the

management of the contract could result in more vehicles for the Army National Guard and Army Reserve. The ratio of old candidate trucks to new trucks appears to be higher than the original 66% program office estimate (Table 3). This higher ratio could result in less money being spent to ship vehicles and tear down old vehicles. This money could then be spent for more trucks overall.

The higher ratios could be the result of several possibilities. The missions of each location differs and therefore the way the vehicles are used differs. Whether the vehicles were used on several short daily runs or used on infrequent, but extended distance runs, may have effected the ratios. Mileage could perhaps provide some clue as to why the ratios differ. But the data appears to be inconclusive, as shown in Table 4. Opposite of what would be expected, some of the ratios were lower where the mileage was higher when compared by location. The low mileage at Tooele Army Depot was probably a result of the vehicles kept in storage and not used.

TABLE 4

MILEAGE/SALVAGE POTENTIAL COMPARISON

	AVERAGE FIXED-SIDE SALVAGE POTENTIAL	AVERAGE MILEAGE PER TRUCK
FT BRAGG	82.95	19,700
FT DEVENS	88.44	22,454
FT DIX	85.46	28,865
FT POLK	70.59	22,285
FT STEWART	78.54	21,661
SELFRIIDGE AIR BASE	97.28	15,828
TOOELE ARMY DEPOT	83.82	12,625

Another possibility as to why the overall ratios were higher than expected could be the way the vehicles are maintained. Usually, before a vehicle in an Army unit is allowed to be used, all mechanical discrepancies must be resolved. This forces the user of the equipment to maintain the vehicle in generally good condition and to be prepared for emergencies. A vehicle could be used, however, if it has minor mechanical discrepancies. What is acceptable and what is not acceptable, regarding minor mechanical discrepancies, could vary slightly by location and maintenance manager.

General opinion among maintenance managers in the Army is that a depot, such as Tooele Army Depot, has a stricter definition of mechanical acceptability than a unit, such as Ft. Bragg. This is because one of the missions of a depot is to fix vehicles whereas the mission of the unit is to use the vehicles toward some particular end (although the vehicles in a unit must be ready for use especially in an emergency). A training operation, such as Ft. Dix, would probably attempt to strictly adhere to the maintenance policies and procedures, as defined by the Army, in order to teach students correctly. In any event, because the vehicles have been intensely maintained over the years, even though the vehicles are old, could mean that the

vehicles are in better than expected condition.

Another possibility, that the ratios are higher than expected, is that the old 2 1/2 ton trucks were engineered under Military Specifications which built in larger margins of tolerance resulting in a robust design. The original 2 1/2 ton truck, for instance, was built to haul 5 tons. This means that the vehicle was underutilized, from a design point of view, with the result being less wear than anticipated on the vehicle and components. Also, these old trucks were designed with slide rules as opposed to computers with design software. Computers allow tighter tolerances because of the inherently more precise calculations. Those greater tolerances and greater margins of error, as compared to today, could also have helped to lead to a more robust design.

Recommendation

The researcher has stated that the sample data indicates the ratio of old trucks to new trucks is higher than originally projected by the Army's Extended Service Program office. The researcher recommends that the salvage potential percentage in this study be applied to each future inspection sheet. This recommendation is twofold. First, to assist Army maintenance managers in the subjective "pass/fail" decision regarding induction of candidate vehicles and

second, to help reduce the overall number of core vehicles disassembled by the contractor as a result of inducting relatively better vehicles. The cost savings accrued as a result of less disassemblies could be then applied to increase the overall purchase quantities. This could potentially give the Government more "bang for the buck".

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GLOSSARY OF ACRONYMS

AAE	Army Acquisition Executive
AMDF	Army Master Data File
ASA (RDA)	Assistant Secretary of the Army (Research, Development, and Acquisition)
CONUS	Continental United States
CTIS	Central Tire Inflation System
DOT	Department of Transportation
DS	Drop-side
EPA	Environmental Protection Agency
EUSA	Eighth United States Army
FMTV	Family of Medium Tactical Vehicles
FORSCOM	Forces Command
FS	Fixed-side
GAO	General Accounting Office
GPO	Government Printing Office
HAC	House Appropriations Committee
HASC	House Armed Services Committee
IAW	In Accordance With
LB	Long Bed
NG/USAR	National Guard/United States Army
	Reserve
NSN	National Stock Number
OEM	Original Equipment Manufacturer
PEO	Program Executive Office

PMCS	Preventive Maintenance Checks and Services
PM-ESP	Product Manager-Extended Service Program
RAM-D	Reliability, Availability, Maintainability, and Durability
RFP	Request for Proposal
SAC	Senate Appropriations Committee
SAE	Society of American Engineers
SASC	Senate Armed Services Committee
SLEP	Service Life Extension Program
TACOM	Tank-Automotive Command
TARP	Theater Army Repair Program
UMTA	Urban Mass Transportation Administration
WO/W	Without Winch
W/W	With Winch
XLWB	Extra Long Wheel Base

APPENDIX 1

**Inspection Sheets for the Induction of Core Material
for the Army's 2 1/2 Ton Truck Extended Service Program**

EXTENDED SERVICE PROGRAM

2 1/2 TON CARGO TRUCK

CANDIDATE VEHICLE INSPECTION RECORD

Instructions for use of this package:

This procedure is unique to the needs of the Extended Service Program. It is important that these inspection procedures be followed precisely and that this package be reviewed by all inspectors prior to performing the inspection.

Each component inspected will be marked either "Pass" or "Fail" in accordance with the specifications written in the attached pages. If any component is questionable, please note your concerns in the "Remarks" column of the Inspection Record. For components that are rusted, specify rust as Stage I, II, III, or IV IAW TB 43-0213 (enclosed).

These vehicles will be remanufactured, that is they will be completely torn down, the salvageable parts recovered, and then the parts used to construct "like-new" vehicles with a new engine, new transmission, and new radial tires. When the vehicles are inducted, they lose their identity. New serial numbers and new model numbers are assigned the vehicles after remanufacture.

Questions? Call MAJ Mike Simpson, DSN 786-8534/8555. Commercial is 313-574-8534/8555. Once the inspection sheets are filled out, you may fax them to MAJ Mike Simpson, DSN 786-8557 or mail them to PM-ESP, SFAE-CS-TVL-ESP, Warren, MI 48397.

Extended Service Program Inspection Record

The following assemblies and components must meet the specifications as described in this record. This inspection program is specific only to the Extended Service Program.

Axle Assemblies - Axle housings must not be bent, cracked, or obviously damaged.

Bumper - Must not be bent or obviously out of alignment. Must be free of cracks. Dents not exceeding 1/2 inch are acceptable when the alignment is not affected.

Rear Bumperettes - Must not be bent or obviously out of alignment. Must be free of cracks. Dents not exceeding 3/4 inch are acceptable when the alignment is not affected. not affected.

Cab - Must be free of breaks and cracks. Indentations of no more than 1/2 inch are acceptable. Dents, sags and bulges in the floor that do not exceed 1/2 inch are acceptable. Note: Pay particular attention to the area between the cab and cargo body.

Inside Cab - Indentations of no more than 1/2 inch are acceptable. Dash panel and glove compartment doors must be complete and serviceable.

Doors - Must be free of breaks, cracks, missing or damaged hardware. Closures and associated hardware must function as intended. Indentations of no more than 1/2 inch are acceptable.

Canvas - Must be free of tears, rips and mildew. Must fit properly. Fading or discoloration is acceptable when it does not affect serviceability.

Cargo Body - Dents, sags, waves, and bulges on body and side panels not exceeding 3/4 inch are acceptable. Non-standard holes greater than 1/2 inch are unacceptable. Closures, end plates, and chain brackets must be properly affixed and functional.

Cushions, seat pads, seat backs and seat frames - Free of ripped, torn, deteriorated coverings; free of sagged or broken springs. Frames must be in good condition. Mismatch of color shades is acceptable.

Differentials - Check for obvious damage; broken cast metal, missing.

Fenders - Free of breaks, cracks, missing or damaged hardware. Indentations of more than 1/4 inch are unacceptable.

Frames, Siderails and Crossmembers - Free from cracks, breaks, loose mountings, and broken welds. Frames obviously out of alignment (by visual inspection) are unacceptable.

Glass - Must be free of cracks. Minor discoloration not more than 1/2 inches from frame on windshield is acceptable. Mountings and frames must be secure. Slight weather checking on rubber seals is acceptable.

Pioneer Tool Racks - Will be complete and undamaged.

Tow Pintles - Pintle must be properly secured to vehicle. Securing cotter pin shall be attached and fastened properly. Wear on pintle shaft or bushing exceeding 1/4 inch is unacceptable.

Rust - Rust is acceptable on all parts of the vehicle if metal is sound. If rust is concealing unsonund metal, component shall be considered unacceptable.

Shock Absorbers - Free of leaks and properly secured.

Spring Assemblies - Free of cracked or broken leaves, broken center bolts and loose or damaged U-bolts. Wear on spring saddle side thrust plates will not exceed 1/8 inch.

Torque Rods - Separation of rubber from metal parts is acceptable if it does not exceed 3/8 inch. Rubber must be resilient.

Trailer Connecting Accessories - Couplings must be intact and functional. Weather checking of hoses is acceptable, providing it does not extend to the hose body core.

Transfer Case - Check for obvious damage, broken cast metal, missing.

Universal Joints - U-joint, sliding couplings, u-joint bearings, center bearings, and pillow blocks will not show rotary lost motion when rotated or shaken by hand.

Weather Stripping and Dust Seals - Weather checking is acceptable. Seals must serve the purpose intended. Paint overspray on weather stripping is acceptable.

Winch - Will not show evidence of fluid leaks or misadjustment. Cable will show no evidence of fraying or deterioration.

ESP VEHICLE INDUCTION INSPECTION SHEET

NSN _____

MILEAGE _____

SERIAL NUMBER _____

CONTRACT # _____

STEP	COMPONENT	COMMENTS	PASS	FAIL
1	FRONT BUMPER			
2	FENDER, DRIVER'S SIDE			
3	DOOR, DRIVER'S SIDE			
4	CAB, EXTERIOR, DRIVER'S SIDE			
5	CAB, INTERIOR AND WINDSHIELD COWL			
6	CANVAS, INCLUDING CAB TOP			
7	GLASS, WINDSHIELD AND FRAMES, SIDE WINDOWS AND FRAMES			
8	CARGO BODY, TAILGATES AND DROPSIDES INCLUDING RACKS AND SEATS			
9	PIONEER TOOL RACKS			
10	TRAILER CONNECTOR ACCESSORIES			
11	TOW PINTLES			
12	REAR BUMPERETTES			
13	CAB, EXTERIOR, PASSENGER SIDE AND BATTERY BOX DOOR			
14	FENDER, PASSENGER SIDE			

STEP	COMPONENT	COMMENTS	PASS	FAIL
	NOTE: FRAME RAILS WILL BE INSPECTED WHILE PERFORMING STEPS 15 THROUGH 25. BEGIN CHECKING FOR LOOSE RIVETS, BREAKS, TWISTS, CRACKS AND BENDS NOW.			
15	SHOCK ABSORBERS			
16	TRANSFER CASE			
17	TORQUE RODS			
18	FRONT AXLE			
19	FRONT DIFFERENTIAL			
20	INTERMEDIATE AXLE			
21	INTERMEDIATE DIFFERENTIAL			
22	REAR AXLE			
23	REAR DIFFERENTIAL			
24	UNIVERSAL JOINTS			
25	SPARE TIRE CARRIER			

2-2. The Four Elements of Rusting.

a. Rusting of iron, steel, or any metal alloy is caused by the electrochemical reaction described in paragraph 2-1. This reaction is divided into four parts or elements:

- (1) A positive reaction.
- (2) A negative reaction.
- (3) A path for negative particles to flow.
- (4) A path for positive particles to flow.

b. In the explanation of the rusting process, the positive and negative polarization of the iron atoms constitute the first two elements. A path for positive and negative particles to flow is described in the "oxidation half" of the "Oxidation-Reduction Reaction." If any of these elements are absent, rust cannot occur. In Figure 2-2, the first element is missing.

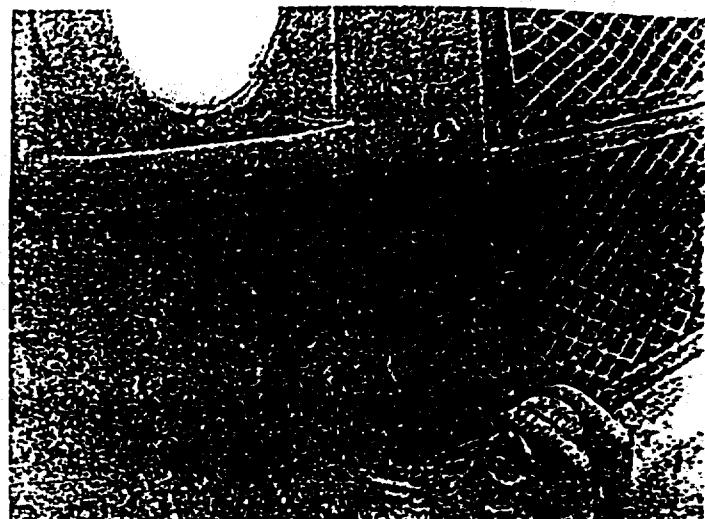
The best method of preventing the rusting process is to coat a nonmetallic substance to the metal and a barrier between the metal and the environment. To some degree, paint accomplishes such a barrier. On well-maintained exterior surfaces, paint will go a long way toward forestalling rust. But nothing can stop rusting altogether. Eventually, moisture will work its way to the metal even beneath rustproofing material.

a. With a greater awareness of rust, the rusting process, the stages of rust, and rustproofing procedures, the damage of this form of corrosion can be minimized within the Army to the point of zero impact upon the service life of any Army vehicle.

2-3. The Four Stages of Rust.

a. Rust has been categorized into four distinct stages. These stages of deterioration have been standardized within the Army in order to communicate the condition of the metal. The four stages apply to painted metal surfaces:

(1) *Stage 1 Rust* (see Figure 2-2) The painted surface is bubbly or the paint bubbles have broken to reveal rusty red, black, or white corrosion deposits on the metal surface. This may be accompanied by minor etching or pitting of the metal. In Stage 1 rust, no scale is present but the metal may have loose, powdery, or granular deposits on the surface. Base metal is sound.



TA504743
Figure 2-2. Stage 1 Rust.

Copy Key to the Corrosion Prevention and Control Program or an update of all vehicle semiannual Preventive Maintenance Checks and Services (PMCS) to emphasize early detection and repair of rust damaged areas before the condition is allowed to advance beyond Stage 2 rust.

(2) *Stage 2 Rust* (see Figure 2-3) Powdered, granular, or scale protection exists on the surface metal. Rusty red, black, or white corrosion deposits are present. Metal surface may be etched or pitted. Metal beneath the corroded area is still sound.



TA504744

Best Available Copy

(3) *Stage 3 Rust* (see Figure 2-4). Surface conditions and corrosion deposits present are similar to Stage 2 except that metal in corroded area is unsound, and small pin holes may be present.

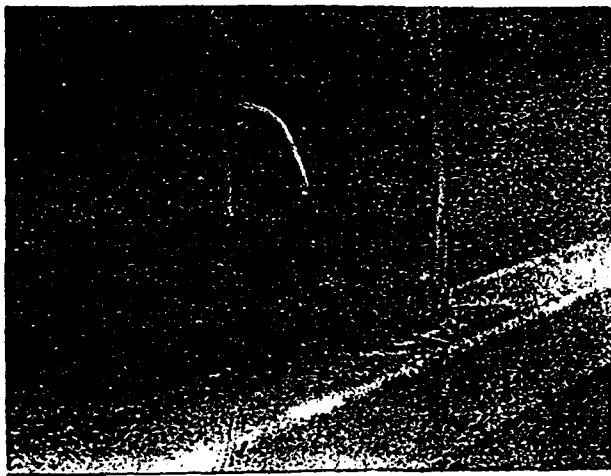


Figure 2-4. Stage 3 Rust.

TA504745

(4) *Stage 4 Rust* (see Figure 2-5). Corrosion has advanced to the point where the metal has been penetrated throughout. No metal remains at the point of severest corrosion. There are holes in the surface area or metal is completely missing along the edges.

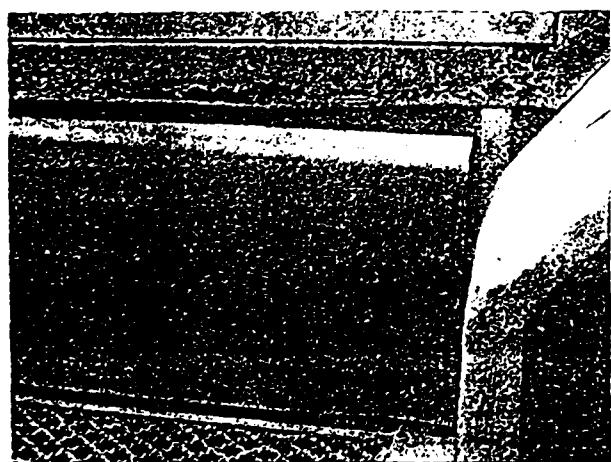


Figure 2-5. Stage 4 Rust.

TA504746

b. Stages of rust are determined by visual inspection as well as by knocking on the metal to determine metal soundness. Probes, spring-loaded punches, or similar devices should be used if the soundness of the metal is in doubt.

2-4. Arresting Rust/Repairing Rust Damage.

a. Stage 1 and Stage 2 rust can be readily repaired. With Stage 3 rust, the metal is unbound and must be cleared of rust and then reinforced, or the affected part must be replaced entirely. Areas showing Stage 4 rust are not repairable. Such parts must be replaced.

b. Rust in Stages 1 and 2 can be removed by use of an abrasive such as a sander, grinder, or wire brush, and/or by application of a rust removing compound. The best approach taken to remove rust depends greatly on the area being repaired as well as by such considerations as metal thickness or accessibility of the rusted area. A metal grinder, for example, would be incorrect for use on thin, short metal. Interior rust in long boxed-in areas close to rubber molding (such as the tube rails of a fold-down window) may require use of a wipe-off rust remover and swab as opposed to a wash-off rust remover. Common sense and an understanding of the tools and materials available must determine the best approach.

c. Whenever rust is located on a vehicle that cannot be immediately repaired, the rust area should at least be treated with rust arresting coating, MIL-R-10036, to prevent further corrosion. Refer to paragraph 2-20 for a description of this material, its application, and hazards.

d. Most Stage 1 and Stage 2 rust is localized and can be easily removed. Larger areas may require use of high pressure washers. If repair is to be done immediately, application of the rust arresting coating (MIL-R-10036) is not necessary. Sand, grind, brush, and/or chemically remove the rust from the metal. Maintenance personnel should be aware of all chemical materials available to assist in removing rust as well as any oils or chemicals on the metal. Paragraphs 2-19 through 2-28 provide a list of these materials.

e. Stage 2 and Stage 3 rust are very similar in appearance. What qualifies rust as Stage 3 depends to a great degree upon the thickness of the metal. Rust could appear as more advanced on the heavy-gaged metal of a cargo or dump body and yet be categorized as Stage 2. What may appear as minor rust on sheet metal may be Stage 3. The difference is in the soundness of the metal. Inspectors looking at the first example of the cargo or dump body may determine by probing and sounding that the metal beneath the rust is still sound. Such rust would be classified as Stage 2. These same inspectors may determine that the less visible rust on the sheet metal has made that metal unbound or unserviceable. The sheet metal rust, therefore, would be categorized as Stage 3.

f. Stage 3 and Stage 4 rust make the rusted part unserviceable. Repairing rust damage in such cases

APPENDIX 2

Pass/Fail Data by Location Based on the Inspection
Sheets at APPENDIX 1

ITEM 1	ITEM 2	ITEM 3	ITEM 4	ITEM 5	ITEM 6	ITEM 7	ITEM 8	ITEM 9	ITEM 10	ITEM 11	ITEM 12	ITEM 13	ITEM 14	ITEM 15	ITEM 16	ITEM 17	ITEM 18	ITEM 19	ITEM 20	ITEM 21	ITEM 22	ITEM 23	ITEM 24	ITEM 25	WINCH		
1	0	213	1927	0	0	0	0	49.69	17.35	156.29	54.33	36.4	29.2	20.26	17.30	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942		
2	425	0	213	1927	79.37	822.05	107.0	49.69	17.35	156.29	54.33	36.4	29.2	20.26	17.30	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942		
3	425	1	3247	213	1927	79.37	0	0	49.69	17.35	156.29	54.33	36.4	29.2	20.26	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942	
4	425	1	3247	213	1927	79.37	922.05	0	24.98	49.69	17.35	156.29	54.33	36.4	0	20.26	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942
5	425	1	3247	213	1927	79.37	822.05	0	24.98	49.69	17.35	156.29	54.33	36.4	0	20.26	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942
6	425	1	3247	213	1927	79.37	79.37	0	0	49.69	17.35	156.29	54.33	36.4	29.2	20.26	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942
7	425	1	3247	213	1927	79.37	79.37	0	107.8	0	49.69	17.35	156.29	54.33	36.4	29.2	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942
8	0	3247	213	1927	79.37	0	0	0	49.69	17.35	156.29	54.33	36.4	29.2	0	20.26	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942
9	0	3247	213	1927	79.37	0	0	0	49.69	17.35	156.29	54.33	36.4	29.2	0	20.26	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942
10	425	1	3247	213	1927	79.37	0	107.8	24.98	49.69	17.35	156.29	54.33	36.4	29.2	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942	
11	425	1	3247	213	1927	79.37	822.05	0	107.8	24.98	49.69	17.35	156.29	54.33	36.4	29.2	0	47.31	57.63	2627.7	2942	2627.7	2942	2627.7	2942	2627.7	2942

SELFRIIDGE AIR NATIONAL GUARD BASE DATA

TRUCK	ITEM 1	ITEM 2	ITEM 3	ITEM 4	ITEM 5	ITEM 6	ITEM 7	ITEM 8	ITEM 9	ITEM 10	ITEM 11	ITEM 12	ITEM 13	ITEM 14	ITEM 15	ITEM 16	ITEM 17	ITEM 18	ITEM 19	ITEM 20	ITEM 21	ITEM 22	ITEM 23	ITEM 24	ITEM 25	WINCH
1	4251	3247	213	1927	7937	62285	1076	24862	4969	1735	15629	5433	364	2921	2026	1730	4731	5763	28277	2042	2942	2027	26682	26682	8641	
2	4251	3247	213	1927	7937	62285	1076	53090	4969	1735	15629	5433	364	2921	2026	1730	4731	5763	28277	2942	28277	2042	26682	26682	8641	
3	4251	0	213	0	7937	62285	0	24862	4969	1735	15629	5433	364	2921	2026	1730	4731	5763	28277	2942	2027	26682	26682	8641		

APPENDIX 3

Mileage, Salvage Potential, and Pass/Fail Summary

Based on the Compiled Data at APPENDIX 2

FT. BRAGG MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCK
14320	78.96236			23855.51		2
24288	77.95495			23551.16		3
9956	85.26372			25759.23		5
28025		77.57187		24688.84		6
	79.46218			24006.51		7
16335	82.39279			23907.29		11
45954		75.78996		24121.71		13
54470	79.84882			24123.32		16
27022	88.57266			26758.9		19
9638	83.99658			25376.41		20
16738	83.70905			24289.22		21
10868	95.10463			28732.29		22
19787	88.91243			26861.55		23
13819	89.46415			27028.23		24
11192	87.44553			26418.38		25
15244	98.17557			29660.06		26
4867	89.11871			26923.87		27
14646	87.08997			26310.96		28
6721	90.00471			27191.54		29
7718	90.52604			27349.04		30
9941	100			30211.24		31
25241	94.74688			28624.21		32
2	91.73089			27713.04		33
37304	83.02830			25083.88		34
36426	86.92849			25223.38		39
11814	83.84995			25332.11		40
16300	83.76688			24306		41
1	85.33317			25780.21		42
12086	86.37076			26093.68		45
6818	96.91949			29280.58		46
3069		93.91486		29890.33		47
61285	83.55121			24243.42		49
7953	87.15119			25288		50
15350	82.20641			23853.21		52
19335	89.27690			25904.8		53
39420	92.67837			26891.78		55
3970		74.09109		23581.01		56
7621	82.27726			23873.77		57
237	78.58502			23741.51		58
51327	77.97501			23557.22		59
13736	86.71767			25162.21		60
21403	87.44553			26418.38		61
8295	86.53802			26144.21		62
2686	85.33317			25780.21		66
40586	95.42714			27689.37		68
5162	91.73089			27713.04		69
13358	80.71893			24386.19		70
8028	82.10599			24805.24		71
18201	79.99751			24168.24		72

FT. BRAGG MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY (CONT)

4792	100		30211.24		73
4966	98.43829		29739.43		76
	88.23457		26656.76		79
3006	100		29016.24		80
6512	87.97331		26577.83		81
14836	86.13049		26021.09		86
6890	75.58439		21931.75		87
20596	82.32989		23889.04		88
20068	89.46415		27028.23		89
18197	86.45752		26119.89		90
99349	85.07135		25701.11		91
237	78.65085		22821.52		92
18418	87.41114		26407.99		93
5877	88.04395		26599.17		94
12385	95.87389		27819		96
51327	76.69639		22254.41		97
18641	88.85600		26844.5		98
3721	84.85325		25635.22		99
	84.59722		25557.87		100
6532	80.49216		24317.68		101
3522	90.66900		27392.23		102
52618	98.93811		29890.43		103
884	89.33152		26988.16		104
12941	82.57585		24947.19		108
3069	92.96400		28085.58		109
75	92.96400		28085.58		110
18203	94.27365		28481.24		111
4835	21.64448		6888.8		112
4592	81.65662		24669.48		113
4492	82.45328		24910.16		114
29275	80.22944		24238.31		115
20751	78.32045		23661.58		116
	85.13437		25720.15		117
	88.23457		26656.76		119
3006	100		29016.24		120
6512	87.97331		26577.83		121
19663	79.92486		23191.19		122
	83.16560		25125.36		123
3083	97.16105		29353.56		124
	81.14423		24514.68		125
14215	90.95879		27479.78		126
7016	98.97979		31502.35		127
19604	87.25805		26361.74		128
18895	82.32989		23889.04		130
2838	79.37406		23979.89		131
17757	81.67840		24676.06		132
55027	62.89887		19002.53		133
2842	83.02883		25084.04		134
2029	83.73386		25297.04		135
16655	86.27530		26064.84		136
69594	84.25840		25455.51		139

FT. BRAGG MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY (CONT)

17957	83.37100			24191.13		141
9570	78.53229			22787.12		142
3349	82.32989			23889.04		143
99349	96.06411			29022.16		145
5162	86.97848			26277.28		146
22120	84.25840			25455.51		148
3083	78.11797			23600.41		149
55027	84.35343			25484.22		150
63040	87.92509			26563.26		151
3019	91.39033			26518.04		153
12008	57.62359			16720.2		154
8186	86.45975			25087.37		155
82091	83.33657			24181.14		156
28641	63.82536			18519.72		157
17628	97.71645			28353.64		158
39592	88.41368			26710.87		159
76382		70.24125		22355.72		160
19953	87.44808			26419.15		161
71883		78.56423		25943.52		162
23338	89.09442			26916.53		163
7143	89.06969			26909.06		164
18899	83.85790			24332.41		165
7594	83.83909			25328.83		166
18375	87.26593			26364.12		167
24286	76.65041				23157.04	168
18264	79.07335				23889.04	169
17726	76.96900				22333.51	170
3737	76.60086				23142.07	171
12008	78.32148				22725.95	1
34369	78.16098				22679.38	4
62753	40.21254				11668.17	8
	75.03587				21772.59	9
25789	74.59109				21643.53	10
16359	76.83537				23212.92	12
69732		67.72578			21555.12	14
41995	77.36544				23373.06	15
	75.61896				21941.78	17
16646	78.20079				23625.43	18
3819	80.54707				24334.27	35
4152	80.41891				24295.55	36
1	83.02883				25084.04	37
	79.47230				24009.57	38
7510	77.98789				23561.11	43
17505	86.03820				25993.21	44
1	78.59829				23745.52	48
12	87.45588			.	25376.41	51
5274	83.43886			.	24210.82	54
14836	83.32372				25173.13	63
76	78.89481				22892.31	64
	84.63060				24556.62	65
17184	76.65041				23157.04	67

FT. BRAGG MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY (CONT)

16280	77.15406				22387.21	74
2221	76.74865				23186.72	75
22116	5.473724				1653.68	77
29161	79.98989				23210.06	78
19663	79.92486				23191.19	82
87959		68.33605			21749.35	83
19663	78.54663				22791.28	84
27832		70.67893			22495.02	85
76	78.89481				22892.31	95
3349	75.09711				21790.36	105
13401			69.26905		23513.54	106
29168	74.80729				22600.21	107
29161	79.98989				23210.06	118
18263	82.13903				24815.22	129
19553	77.68148				23468.54	137
17184	76.35777				23068.63	138
14812	5.085462				1475.61	140
54471	80.80568				24412.4	144
13803	77.85526				23521.04	147
7651	75.38409				21873.63	152

FT. DEVENS MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCKS
29824	85.90557			25953.14		1
14831	98.92523			29886.54		2
34856	81.29433			23588.56		3
24695	92.65959			26886.33		4
18126	91.37403			27605.23		5
22498	82.03423			24783.56		6
22741	82.59233			23965.19		7
5510	83.28089			25160.19		8
10836	85.79123			24893.39		9
36282	89.00723			26890.19		10
26795	100			29016.24		11

FT. DIX MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCK
	99.72646			28936.87		1
12392	78.09623			22660.59		2
25667	93.86739			27236.79		3
8787	94.63700			27460.1		4
227	88.46401			25668.93		5
	69.37635			20130.41		6
24862	96.99292			28143.7		7
	80.55688			25638.88		8
27463	88.73940			25748.84		9
	94.65875			30127.09		10
	88.93795			25806.45		11
53884	87.65057			25432.9		12
36323	90.66446			26307.42		13
25113	87.74413			25460.05		14
	88.06092			25551.97		15
	85.58348			24833.11		16
35412	61.44307			17828.47		17
	80.57029			23378.47		18
	81.92725			23772.21		19
48106	62.03302			17999.65		20
37641	91.73089			27713.04		21
15422	100			30211.24		22
	67.42609			20370.26		23
	80.86112			24429.15		24
	97.73326			29526.43		25
	85.96045			25969.72		26
	90.12526			27227.96		27
	84.50116			25528.85		28
1737	97.01362			29309.02		29
6418	79.59034			25331.26		30
	35.81239			11398.03		31
57855	72.68788			23134.41		32
45360	96.90539			30842.13		33
3208	94.32002			30019.28		34
41456	87.62332			27887.92		35
18375	98.82367			31452.66		36
40815	79.83488			25409.09		37
20817	97.83894			31139.25		38
	96.30823			30652.07		39
	98.11493			31227.09		40
23464	78.43004			24961.97		41
39566	95.93729			30534.01		42
45091	80.34495			25571.43		43
32614	97.41484			31004.27		44
	79.59034			25331.26		45
37776	78.18412			24883.7		46
22518	97.34103			30980.78		47
30613	76.83426			24454.08		48
22344	96.95262			30857.16		49
39277	87.71921			27918.44		50
57449	96.99673			30871.2		51
14514	78.65941			25034.97		52
	73.19566			21238.63		53

FT. POLK MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCK
10073		31.32681		9970.4		1
4890	94.44442			27404.22		2
6363			47.92891	16269.58		3
67915	81.32016			24567.83		4
6344		46.87446		14918.76		5
9032		44.54902		14178.64		6
36983	54.30233			16405.41		7
5143	53.96537			16303.61		8
57913	46.75054			14123.92		9
27811				14451.01		10
99504		45.11297		14358.13		11
33111	53.13290			16052.11		12
6296	57.83446			17472.51		13
15712		38.53121		12263.35		14
33547		62.26851		19818.23		15
42433	56.29954			17008.79		16
8560	46.04007			13359.1		17
9902		49.86201		15869.61		18
28915	50.01399			14512.18		19
17813	86.63305			26172.92		20
989	93.47930			27124.18		21
11697	96.68823			28055.29		22
25128		85.60328		27245		23
1166		80.17529		25517.43		24
15809	85.17061			25731.1		25
12690	82.88312			25040.02		26
		67.41259		21455.44		27
26158		70.19802		22341.96		28
24440		78.53024		24993.86		29
17165		95.41327		30367.23		30
34106	58.27850			16910.23		31
9067		66.12394		21045.3		32
33711		66.91961		21298.54		33
16084		60.05938		19115.13		34
21783	98.89437			28695.43		35
463		73.42207		23368.08		36
7577	87.30004			25331.19		37
28178		92.82462		29543.34		38
10410		77.05445		24524.16		39
19640		79.16489			25195.85	40
27916	45.05380				13072.92	41
11463		53.80215			17123.64	42
5547	50.85338				14755.74	43
95717		41.15785			13099.33	44
1143			41.95178	.	14240.63	45
2511	54.55214			.	15828.98	46
4205	51.25278				14871.63	47
8138	47.10177				14230.03	48
14493		38.75759			12335.4	49
20116	75.85307				22009.71	50

FT. POLK MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY (CONT)

	76.64756				23156.18	51
306	66.39233				19264.56	52
16095	78.44758				22762.54	53
	77.33108				23362.68	54
10277	76.26405				22128.96	55
4106	80.65893				23404.19	56
65736	80.86463				24430.21	57
9216		77.94693			24808.21	58
22092	78.17212				22682.61	59
21754		71.19516			22659.32	60
29280	76.56674				22216.79	61
46472	79.11605				23901.94	62
17132	76.11816				22086.63	63
5602	74.76233				21693.22	64
97981	82.63162				23976.59	65
22168		70.72336			22509.16	66

FT. STEWART MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCK
14851		93.04981		29615.01		18
31457	83.39257			25193.93		2
5173	87.16839			25292.99		13
15860	97.79668			28376.92		4
2077	87.08526			25268.87		5
27882	66.01923			19156.3		11
13268	95.67097			27760.12		7
15096	85.08135			24687.41		10
70836	75.02138				22664.89	9
35547	77.63775				23455.33	8
23867					25906.35	6
35014	54.12134				15703.98	12
24196		69.33944			22068.7	3
7798	68.36381				19836.61	14
16036	76.15357				23006.94	15
24577	72.01194				20895.16	16
1794	74.05246				21487.24	17
25013		68.00356			21643.53	1
10756		67.28729			21415.56	19
32134		61.64005			19618.21	20

SELFRIIDGE MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCK
20800	100			30211.24		1
14362		100		31827.05		2
12323	91.86831			26656.73		3

TOOELE MILEAGE, SALVAGE POTENTIAL, AND PASS/FAIL SUMMARY

MILEAGE	FS %	DS %	LB %	PASS	FAIL	TRUCK
3021	96.62685			29192.17		1
3698	95.69842			28911.68		2
22710	98.30003			29697.66		3
22545	86.23250			26051.91		4
		94.73246		31025.1		5
24844		97.21754		31838.97		6
13819		91.33361		29911.97		7
		70.95037		23236.41		8
12546		81.38000		27624.63		9
11546		97.31549		33033.97		10
4555		76.42929		25944.1		11
10360		77.38583		26268.8		12
28628	78.02319			24832.48		13
3149	77.94140			24806.45		14
259	99.72221			31738.64		15
9132	70.56293			22458.1		16
9102	93.89726			29884.73		17
7291	81.89061			27041.96		18
1198	77.16737			22391.07		19
15962	97.67095			28340.44		20
24050	97.86640			28397.15		21
34199	90.00914			26117.27		22
8182	99.69530			28927.83		23
10190	78.88722			23832.81		25
9401	3.955481				1195	24

APPENDIX 4

Pass/Fail, Mileage, and Truck Type Statistics

Based on the Summary Data at APPENDIX 3

FT. BRAGG STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS	124	31502	6888.	25596	2808.	7888062.
FAIL	47	25993	1475.	22136	4760.	22664127
ALL	171	31502	1475.	24645	3786.	14334890
MIL PASS		99349	1	19592	20692	4.3E+08
MIL FAIL		87959	1	19995	18880	3.6E+08
MIL ALL		99349	1	19700	20222	4.1E+08
FS PASS	116	100	57.62	86.06	6.992	48.89339
FS FAIL	43	87.45	5.085	74.55	16.63	276.6619
FS ALL	159	100	5.085	82.95	11.68	136.6170
DS PASS	8	98.97	21.64	73.84	21.83	476.5553
DS FAIL	3	70.67	67.72	68.91	1.272	1.620289
DS ALL	11	98.97	21.64	72.50	18.75	351.8603
LB PASS	0					
LB FAIL	1					
LB ALL	1					

FT. DEVENS STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS						
FAIL						
ALL	11	29886	23588	26238	1932.	3736076.
MIL PASS						
MIL FAIL						
MIL ALL		36282	5510	22454	9156.	83837229
FS PASS						
FS FAIL						
FS ALL	11	100	81.29	88.44	6.300	39.69583
DS PASS						
DS FAIL						
DS ALL						
LB PASS						
LB FAIL						
LB ALL						

FT. DIX STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS						
FAIL						
ALL	53	31452	11398	26236	3939.	15520301
MIL PASS						
MIL FAIL						
MIL ALL	33	57855	227	28865	15660	2.5E+08
FS PASS						
FS FAIL						
FS ALL	28	100	61.44	85.46	10.51	110.5966
DS PASS						
DS FAIL						
DS ALL	25	98.82	35.81	86.29	13.50	182.2699
LB PASS						
LB FAIL						
LB ALL						

FT POLK STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS	39	30367	9970.	20594	5585.	31203086
FAIL	27	25195	12335	20066	4230.	17898029
ALL	66	30367	9970.	20378	5082.	25827371
MIL PASS		99504	463	21707	19790	3.9E+08
MIL FAIL		97981	306	23164	26048	6.8E+08
MIL ALL		99504	306	22285	22494	5.1E+08
FS PASS	18	98.89	46.04	71.30	19.06	363.3804
FS FAIL	19	82.63	45.05	69.92	12.57	158.0721
FS ALL	37	98.89	45.05	70.59	16.07	258.4230
DS PASS	19	95.41	31.32	64.85	17.81	317.2865
DS FAIL	7	79.16	38.75	61.82	15.81	250.1673
DS ALL	26	95.41	31.32	64.03	17.35	301.0279
LB PASS	1					
LB FAIL	1					
LB ALL	2			44.94		

FT STEWART STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS	8	29615	19156	25668	2982.	8897820.
FAIL	12	25906	15703	21475	2371.	5623224.
ALL	20	29615	15703	23152	3339.	11154042
MIL PASS		31457	2077	15708	9354.	87514170
MIL FAIL		70836	1794	25630	17025	2.9E+08
MIL ALL		70836	1794	21661	15249	2.3E+08
FS PASS	7	97.79	66.01	86.03	9.577	91.72848
FS FAIL	7	77.63	54.12	71.05	7.454	55.56455
FS ALL	14	97.79	54.12	78.54	11.39	129.7382
DS PASS	1					
DS FAIL	4					
DS ALL	5					
LB PASS						
LB FAIL						
LB ALL						

SELFRIIDGE STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS	3					
FAIL						
ALL	3			97.28		
MIL PASS						
MIL FAIL						
MIL ALL				15828		
FS PASS						
FS FAIL						
FS ALL						
DS PASS						
DS FAIL						
DS ALL						
LB PASS						
LB FAIL						
LB ALL						

TOOELE STATISTICS

	COUNT	MAX	MIN	AVG	STDVN	VAR
PASS	24	33033	22391	27562	2959.	8757499.
FAIL	1		1195			
ALL	25	33033	1195	26508	5924.	35105141
MIL PASS		34199	259	12772	9315.	86770142
MIL FAIL			9401			
MIL ALL		34199	259	12625	9136.	83470143
FS PASS	10	99.69	77.16	91.81	7.933	62.94071
FS FAIL	1		3.955			
FS ALL	11	99.69	3.955	83.82	26.36	695.1832
DS PASS	6	99.72	70.56	83.67	10.01	100.3225
DS FAIL						
DS ALL	6					
LB PASS	8	97.31	70.95	85.84	9.823	96.50226
LB FAIL						
LB ALL	8					